44. A vertical cavity surface emitting laser comprising:

a substrate;

a first mirror formed adjacent to said substrate;

an active region formed adjacent to said first mirror;

a semiconductor mirror formed adjacent to said active region, said semiconductor mirror comprising a plurality of semiconductor mirror layers;

an anti-phase layer formed on said semiconductor mirror;

an annular reflector formed on said anti-phase layer wherein reflections from said reflector are substantially out of phase with reflections from said semiconductor mirror layers to provide mode selective optical loss in order to suppress higher order modes.

45. The vertical cavity surface emitting laser of claim 44 further comprising:

a re-phase layer formed on said anti-phase layer and within said annular reflector.

46. The vertical cavity surface emitting laser of claim 45 wherein a total thickness of said anti-phase layer and said re-phase layer is substantially an integer multiple of ½ wavelength.

47. The vertical cavity surface emitting laser of claim 45 further comprising:

a dielectric mirror formed adjacent to said re-phase layer, said dielectric mirror comprising a plurality of dielectric mirror layers.

48. The vertical cavity surface emitting laser of claim 46 further comprising:

a dielectric mirror formed adjacent to said re-phase layer, said dielectric mirror comprising a plurality of dielectric mirror layers.

49. The vertical cavity surface emitting laser of claim 44 wherein said anti-phase layer is formed from a semiconductor material.

50. The vertical cavity surface emitting laser of claim 45 wherein said anti-phase layer is formed from a semiconductor material.

51. The vertical cavity surface emitting laser of claim 45 wherein said re-phase layer is formed from a dielectric material.

52. The vertical cavity surface emitting laser of claim 49 wherein said re-phase layer is formed from a dielectric material.

53. The vertical cavity surface emitting laser of claim 44 wherein said annular reflector comprises a conductive metallic material forming an ohmic contact.

54. The vertical cavity surface emitting laser of claim 44 wherein said anti-phase layer is planar.

55. The vertical cavity surface emitting laser of claim 45 wherein said anti-phase layer and said re-phase layer are planar.

56. The vertical cavity surface emitting laser of claim 44 wherein said annular reflector comprises a step function mesa formed in the surface of said anti-phase layer.

57. A vertical cavity surface emitting laser comprising:

a substrate;

a first mirror formed adjacent to said substrate;

an active region formed adjacent to said first mirror;

a semiconductor mirror formed adjacent to said active region, said semiconductor mirror comprising a plurality of semiconductor mirror layers;

an anti-phase layer formed on said semiconductor mirror;

an annular reflector formed on said anti-phase layer, said annular reflector defining an optical axis of said laser,

said anti-phase layer and said annular reflector cooperating to suppress higher order modes at a predetermined radial distance from said optical axis wherein reflections from said

reflector are substantially out of phase with reflections from said semiconductor mirror layers to provide mode selective optical loss at said predetermined radial distance from said optical axis, while also allowing a fundamental mode to propagate along said optical axis.

58. The vertical cavity surface emitting laser of claim 57 further comprising:
a re-phase layer formed on said anti-phase layer and within said annular reflector.

59. The vertical cavity surface emitting laser of claim 58 wherein a total thickness of said anti-phase layer and said re-phase layer is substantially an integer multiple of ½ wavelength.

60. The vertical cavity surface emitting laser of claim 58 further comprising:
a dielectric mirror formed adjacent to said re-phase layer, said dielectric mirror comprising a plurality of dielectric mirror layers.

61. The vertical cavity surface emitting laser of claim 59 further comprising:
a dielectric mirror formed adjacent to said re-phase layer, said dielectric mirror comprising a plurality of dielectric mirror layers.

62. The vertical cavity surface emitting laser of claim 57 wherein said anti-phase layer is formed from a semiconductor material.

63. The vertical cavity surface emitting laser of claim 58 wherein said anti-phase layer is formed from a semiconductor material.

64. The vertical cavity surface emitting laser of claim 58 wherein said re-phase layer is formed from a dielectric material.

65. The vertical cavity surface emitting laser of claim 62 wherein said re-phase layer is formed from a dielectric material.

66. The vertical cavity surface emitting laser of claim 57 wherein said annular reflector comprises a conductive metallic material forming an ohmic contact.

67. The vertical cavity surface emitting laser of claim 57 wherein said anti-phase layer is planar.

68. The vertical cavity surface emitting laser of claim 58 wherein said anti-phase layer and said re-phase layer are planar.

69. The vertical cavity surface emitting laser of claim 57 wherein said annular reflector comprises a step function mesa formed in the surface of said anti-phase layer.

70. A vertical cavity surface emitting laser comprising:

a substrate;

a first semiconductor mirror formed adjacent to said substrate;

an active region formed adjacent to said first semiconductor mirror;

a second semiconductor mirror formed adjacent to said active region, said second semiconductor mirror comprising a plurality of semiconductor mirror layers;

a planar semiconductor anti-phase layer formed on said semiconductor mirror, said anti-phase layer comprising a semiconductor mirror layer;

an annular ohmic contact formed on said anti-phase layer, said annular ohmic contact defining an optical axis of said laser and providing an annular reflective surface at a predetermined radial distance from said optical axis,

said anti-phase layer and said annular reflective surface cooperating to suppress higher order modes at a predetermined radial distance from said optical axis wherein reflections from said reflective surface are substantially out of phase with reflections from said semiconductor mirror layers to provide mode selective optical loss at said predetermined radial distance from said optical axis, while also allowing a fundamental mode to propagate along said optical axis;

a planar dielectric re-phase layer formed on said semiconductor anti-phase layer; and

a dielectric mirror formed on said dielectric re-phase layer, said dielectric mirror comprising a plurality of dielectric mirror layers, wherein said dielectric re-phase layer comprises a dielectric mirror layer and further wherein a total thickness of said anti-phase layer and said re-phase layer is substantially an integer multiple of ½ wavelength.

71. A vertical cavity surface emitting laser comprising:

a substrate;

a first mirror formed adjacent to said substrate;

an active region formed adjacent to said first mirror;

a semiconductor mirror formed adjacent to said active region, said semiconductor mirror comprising a plurality of semiconductor mirror layers;

a planar anti-phase layer formed on said semiconductor mirror;

an annular reflector formed on said anti-phase layer, said annular reflector defining an optical axis of said laser,

said anti-phase layer and said annular reflector cooperating to suppress higher order modes at a predetermined radial distance from said optical axis wherein reflections from said reflector are substantially out of phase with reflections from said semiconductor mirror layers to provide mode selective optical loss at said predetermined radial distance from said optical axis, while also allowing a fundamental mode to propagate along said optical axis; and

a planar re-phase layer formed on said anti-phase layer,

wherein a planar thickness of said anti-phase layer and said re-phase layer is spatially varied with a step function at a predetermined radial distance from said optical axis to introduce a lateral index guide.

72. The vertical cavity surface emitting laser of claim 71 wherein a total thickness of said anti-phase layer and said re-phase layer is substantially an integer multiple of ½ wavelength.

73. The vertical cavity surface emitting laser of claim 71 further comprising:

a dielectric mirror formed adjacent to said re-phase layer, said dielectric mirror comprising a plurality of dielectric mirror layers.

74. The vertical cavity surface emitting laser of claim 72 further comprising:

a dielectric mirror formed adjacent to said re-phase layer, said dielectric mirror comprising a plurality of dielectric mirror layers.

75. The vertical cavity surface emitting laser of claim 71 wherein said anti-phase layer is formed from a semiconductor material.

B1 end

76. The vertical cavity surface emitting laser of claim 72 wherein said anti-phase layer is formed from a semiconductor material.

77. The vertical cavity surface emitting laser of claim 72 wherein said re-phase layer is formed from a dielectric material.

78. The vertical cavity surface emitting laser of claim 76 wherein said re-phase layer is formed from a dielectric material.

79. The vertical cavity surface emitting laser of claim 71 wherein said annular reflector comprises a conductive metallic material forming an ohmic contact.

REMARKS

This amendment is responsive to the Official Action dated September 25, 2002. Claims 1 - 43 were pending in the application. Claims 17-20 were withdrawn from consideration as being drawn to a non-elected species.

By way of this amendment, claims 1 - 43 have been canceled in favor of new claims 44 - 79 which are believed to better define the invention.

Accordingly, claims 44 - 79 are currently pending in the application.